Interim Geologic Map of the Kolob Reservoir Quadrangle, Washington and Iron Counties, Utah

By

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Open-File Report 387 **April, 2002**
Utah Geological Survey
a division of
Utah Department of Natural Resources
in cooperation with
U.S. Department of the Interior, National Park Service, Division of Geologic Resources

KOLOB RESERVOIR QUADRANGLE

Map Unit Descriptions

QUATERNARY

Alluvial deposits

Qaly **Younger stream deposits** (Holocene) – Stratified, moderately to well-sorted sand, silt, clay, and pebble to boulder gravel in river channels and flood plains; locally includes small alluvial-fan and colluvial deposits, and minor terraces up to 20 feet (6 m) above current base level. Generally 0 to 30 feet (0-9 m) thick.

Qas **Alluvial sand deposits** (upper Holocene) – Well-sorted, fine- to medium-grained sand mapped on the floor of Hop Valley, where the Hop Valley stream has reworked the upper few feet of sandy lacustrine and basin-fill deposits.

Qaf_1 **Alluvial-fan deposits** (Holocene) **–** Poorly to moderately sorted, non-stratified, boulder- to clay-size sediment deposited as small discrete alluvial fans along major drainages. Form active depositional surfaces, although locally the master stream is deeply entrenched. Typically overlies alluvial channel deposits at the toe of the fans, and may include minor slopewash and talus along the upslope margins of the fans. Many small fans, because they are too small to depict at this scale and because they are typically poorly developed, are lumped with mixed alluvial and colluvial deposits. Generally 0 to 30 feet (0-9 m) thick.

Artificial deposits

Qf **Artificial fill** (Historical) – Engineered fill used to create the Kolob Reservoir and Blue Springs Reservoir dams. Unmapped fill is locally present in developed areas, many of which are shown on the topographic base map. Thickness variable.

Colluvial deposits

Qc **Colluvial deposits** (Holocene to Pleistocene) **–** Poorly sorted, angular, clay- to boulder-size, locally derived sediment deposited principally by slopewash and soil creep. Gradational with talus deposits and mixed alluvial and colluvial deposits. Locally includes large areas of talus where slope angles increase such that colluvium and talus form a thin mantle that grades from one deposit to another. Generally less than 20 feet (6 m) thick.

Lacustrine and basin-fill deposits

Qla **Lacustrine and basin-fill deposits** (Holocene) – Well-stratified sand, silt, and lesser clay deposited in Hop Valley Lake. Typically grades into colluvial and alluvial-fan deposits at basin margins. Forms planar surfaces that slope downstream, and which are incised about 40 feet (12 m) at the south end of Hop Valley. A radiocarbon age of 2,640 $\pm$ 60 yr B.P. establishes a minimum age for the formation of Hop Valley Lake, and Eardley (1966) obtained a radiocarbon age of 670 $\pm$ 200 yr B.P. from the upper part of the deposits. Deposits in Hop Valley could be as much as 350 feet (107 m) thick, but are probably less than 60 feet (18 m) thick in this quadrangle.

Mass-movement deposits

Qmsh, Qmsy, Qmso

Landslide deposits (Historical to Pleistocene) – Very poorly sorted, clay- to boulder-size, locally derived material deposited by rotational and translational movement. Characterized by hummocky topography, numerous internal scarps, and chaotic bedding attitudes. Basal slip surfaces most commonly form in the lower unit of the Co-op Creek Limestone Member of the Carmel Formation, the Dakota Formation, and the upper unit of the Straight Cliffs Formation; the slides themselves incorporate these and overlying map units. The Dakota Formation especially forms very large, complex mass movements. Qmsh denotes slides with historical movement; younger landslides (Qmsy) may have historical movement, but typically are characterized by slightly more subdued landslide features indicative of early Holocene to late Pleistocene age. Older landslides (Qmso) are deeply incised and their head scarps and hummocky topography have been extensively modified by erosion; they are likely late Pleistocene in age. Thickness highly variable.

Qmt **Talus deposits** (Holocene to upper Pleistocene) – Very poorly sorted, angular boulders and finer-grained interstitial sediment deposited principally by rock fall on and at the base of steep slopes. Typically grades downslope into colluvial deposits, and may include colluvial deposits where impractical to differentiate the two. Generally less than 30 feet (10 m) thick.

Mixed-environment deposits

Qac, Qaco

Alluvial and colluvial deposits (Holocene to upper Pleistocene) – Poorly to moderately sorted, generally poorly stratified, clay- to boulder-size, locally derived sediments deposited principally in swales, small drainages, and the upper reaches of larger streams by fluvial,

slopewash, and creep processes; gradational with both alluvial and colluvial deposits. Qac deposits form active depositional surfaces and are generally less than 20 feet (6 m) thick; Qaco deposits are deeply incised and of similar thickness.

Qae, Qaeo

Alluvial and eolian deposits (Holocene to Pleistocene) – Locally derived, fine- to coarse-grained sand and silt with subangular to angular gravel. Deposited in topographic depressions by slopewash and wind; includes small alluvial fans and colluvium along margins of deposits. Qae deposits are mapped in the vicinity of Home Valley Knoll where they locally conceal the Lava Point flow; Qaeo deposits mapped at the south end of Hop Valley tend to be coarser and have a thick pedogenic carbonate (caliche) soil partly mantled by windblown sand. 0 to 20 feet (0-6 m) thick.

Qer **Eolian and residual deposits** (Holocene to Pleistocene) – Reddish-orange, fine- to medium-grained sand with residual Navajo Sandstone gravel, cobbles, and boulders. Forms irregular sheets on top of the Navajo Sandstone, from which it is derived, in the southwest corner of the quadrangle. Generally less than 3 feet (1 m) thick.

Residual deposits

Qrlc **Residual deposits** – Residual lag of angular to subangular basalt blocks derived from the Little Creek Peak flow, which is preserved in place on the ridge to the west. Includes very rare blocks of Dakota sandstone. Although Little Creek Peak basalt is virtually the only rock type seen, nowhere is it seen to be clearly in place. It probably represents a lag of basalt let down

by erosion of underlying beds, but may represent a flow that cascaded southeastward from the adjacent ridge. Thickness uncertain, but probably up to several tens of feet thick.

Spring deposits

Qst **Spring tufa** (Holocene) – Light-gray to light-brownish-gray, porous, calcareous tufa characterized by a sponge-like network of vesicles. Mapped at Birch Spring. 0 to about 20 feet (0-6 m) thick.

Volcanic rocks

Qbg **Grapevine Wash flows** (middle Pleistocene) – Medium-gray, weathering to dark-brownish-gray to dark-brownish-black, fine-grained olivine basaltic trachyandesite. Erupted from a number of vents on the Lower Kolob Plateau, including the Firepit Knoll and Spendlove Knoll cinder cones. Five $^{40}Ar/^{39}Ar$ ages on these flows range from 0.22 $\pm$ 0.03 Ma to 0.31 $\pm$ 0.02 Ma. Only distal end of one flow is preserved at the south end of Hop Valley, where it is about 20 feet (6 m) thick.

Qbhp, Qbhpc

Hornet Point flow and cinder cone (lower Pleistocene) – Medium to dark-gray, medium- to coarse-grained olivine basalt to trachybasalt with abundant pyroxene phenocrysts. Locally deeply weathered to gruss-like soils; boulders typically have concentric weathering rinds. Erupted from deeply weathered cinder cone (Qbhpc) at Hornet Point. Yielded $^{40}Ar/^{39}Ar$ age of 0.74 $\pm$ 0.05 Ma from sample in the Cogswell Point quadrangle (Biek and Hylland, in press). Up to 240 feet (73 m) thick.

Qbkp, Qbkpc

Kolob Peak flow and cinder cone (lower Pleistocene) – Medium- to light-gray, fine-grained olivine basaltic trachyandesite. Forms densely vegetated dip slope on the east side of Kolob Peak. Erupted from Kolob Peak, a cinder cone (Qbkpc) now eroded nearly in half. Yielded $^{40}Ar/^{39}Ar$ age of 1.05 $\pm$ 0.05 Ma. Thickness uncertain, but likely in excess of 100 feet (30 m) thick where it fills paleodrainages.

Qblp, Qblp?, Qblpc

Lava Point flow and cinder cones (lower Pleistocene) – Light- to medium-gray, fine- to medium-grained olivine basaltic trachyandesite to borderline basaltic andesite and trachybasalt. Query indicates uncertain correlation near Blue Springs Reservoir. Erupted from Home Valley Knoll, a group of three overlapping cinder cones (Qblpc). Yielded $^{40}Ar/^{39}Ar$ ages of 1.02 $\pm$ 0.03 Ma and 1.08 $\pm$ 0.02 Ma for this flow at Lava Point, in accord with several published K-Ar and $^{40}Ar/^{39}Ar$ ages. Up to 120 feet (37 m) thick where it fills paleodrainages.

Qblc **Little Creek Peak flow** (lower Pleistocene) – Medium-gray, fine- to medium-grained olivine basalt. Locally caps ridge south of Little Creek Peak; the slope to the east is covered by a basalt lag derived from this flow. Yielded $^{40}Ar/^{39}Ar$ age of 1.44 $\pm$ 0.04 Ma from sample in The Guardian Angels quadrangle (Willis and Hylland, in preparation). 0 to 30 feet (0-9 m) thick. Source unknown.

unconformity

QUATERNARY-TERTIARY

Deposits of uncertain origin

QTng **Old boulder gravel deposits** – Poorly sorted, clay- to very large-boulder-size sediment characterized by very large quartz monzonite boulders probably derived from the Pine Valley Mountains. Clasts also include large boulders of Cretaceous sandstone and fossiliferous sandstone; cobbles and small boulders derived from the Carmel Formation; recycled, rounded pebbles and small cobbles of Precambrian and Cambrian quartzite; and uncommon cobbles and boulders of Claron limestone. Except for the quartzite, most clasts are subangular to subrounded. Quartz monzonite boulders up to 24 feet (7.3 m) long, 22 feet (6.7 m) wide, and at least 8 feet (2.4 m) thick are present in the vicinity of Kolob Reservoir, and subspherical clasts 10 to 15 feet (3-5 m) long are common; most quartz monzonite clasts, however, are 1.5 to 3 feet (0.5-1 m) in diameter. Forms a deeply eroded surface that drapes over pre-existing topography. Two basalt boulders apparently incorporated into the deposits at Kolob Reservoir have a chemical signature similar to the Horse Ranch Mountain flow, and one boulder yielded an $^{40}Ar/^{39}Ar$ age of 0.97 $\pm$ 0.18 Ma, analytically indistinguishable from the 1.03 $\pm$ 0.06 Ma Horse Ranch Mountain flow. Probably deposited by debris flows originating in the ancestral Pine Valley Mountains, which would require a complete east-to-west reversal of drainage across the Hurricane fault. However, because this young age conflicts with known slip rates on the Hurricane fault and doesn't provide the time necessary for the drainage reversal since their emplacement, we chose an uncertain Quaternary-Tertiary designation. Thickness uncertain, but probably less than 10 to 20 feet (3-6 m) thick.

unconformity

CRETACEOUS

Straight Cliffs Formation

Ksu **Upper unit** – Slope-forming, grayish-orange to yellowish-brown, thin- to thick-bedded, fine-grained subarkosic sandstone and gray mudstone and shale; contains a few thin coal beds, common carbonaceous shale, and several thin coquina beds. Forms broad, rounded hills typically mantled with unmapped colluvium. Deposited in fluvial, flood-plain, and lagoonal environments of a coastal plain. Up to 320 feet (100 m) thick in the quadrangle, but upper contact not preserved.

Kst **Tibbet Canyon Member** – Grayish-orange to yellowish-brown, generally medium- to thick-bedded, planar-bedded, fine- to medium-grained quartzose sandstone and lesser interbedded, grayish-orange to gray mudstone and siltstone. Locally fossiliferous with pelecypods, gastropods, and thin to thick beds of oyster coquina. Typically forms bold cliffs, but in this quadrangle more commonly weathers to steep, vegetated slopes. Upper contact corresponds to a break in slope and is placed at the top of a coquinoid oyster bed that caps the lower unit. Deposited in shoreface, lagoonal, estuarine, and flood-plain environments of a coastal plain. About 240 to 500 feet (73-168 m) thick.

KJu **Dakota Formation, Cedar Mountain Formation, and Winsor Member of the Carmel Formation, undivided** – Mapped in the vicinity of Little Creek Peak where access was denied. Winsor strata are likely present at the lowest elevations and Cedar Mountain strata may be present, but the Dakota Formation is present over most of this area.

Kd **Dakota Formation** – Interbedded, slope- and ledge-forming sandstone, siltstone, mudstone, claystone, carbonaceous shale, coal, and marl. Sandstone is yellowish brown or locally white, thin to very thick bedded, fine to medium grained; includes two prominent cliff-forming sandstone beds each several tens of feet thick in the upper part of the formation. Mudstone and claystone are gray to yellowish brown and commonly smectitic. Oyster coquina beds, clams, and gastropods, including large *Craginia* sp., are common, especially in the upper part of the section. Uppermost marl beds above the uppermost sandstone cliff contain distinctive gastropods with beaded edge (samples KRF in sections 14 and 23, T. 38 S., R. 11 W.). Dakota strata are typically poorly exposed and involved in widespread landsliding. Overlying Tropic Shale, if present, is restricted to the east part of the quadrangle where it is silty and sandy, no more than a few feet thick, and is included in this map unit. Upper contact placed at the top of a slope-forming, coaly and marly mudstone interval and at the base of the typically cliff-forming sandstone of the lower unit of the Straight Cliffs Formation. Deposited in a variety of flood-plain, estuarine, lagoonal, and swamp environments; invertebrate and palynomorph fossil assemblages indicate shallow-marine, brackish, and fresh-water deposits of Cenomanian age. Probably about 850 feet (260 m) thick.

Kd(s) **Dakota Formation, slumped** – Large, relatively intact bedrock blocks that slumped downslope. Variable thickness up to about 150 feet (45 m).

unconformity

Cedar Mountain Formation

Kcmc **Conglomerate member** – Thick- to very thick-bedded, yellowish-brown, channel-form conglomerate, pebbly sandstone, and pebbly gritstone. Clasts are subrounded to rounded, pebble- to small-cobble-size quartzite, chert, limestone, and rare, reworked petrified wood. Locally stained reddish-brown to dark-yellowish-brown. Forms two small exposures southwest of Birch Spring and southeast of Little Creek Peak. Deposited in river-channel environment on broad, coastal plain. Yielded a single-crystal $^{40}Ar/^{39}Ar$ age of 97.9 $\pm$ 0.5 Ma on sanadine from a volcanic ash in Cedar Mountain mudstone immediately above this conglomerate bed in the Straight Canyon quadrangle to the east (Biek and Hylland, in press); recent pollen analyses also indicate an Albian or older age for these beds. Upper contact not exposed. 20 to 35 feet (6-11 m) thick.

unconformity (K)

JURASSIC

Carmel Formation

Jcw **Winsor Member –** Light-reddish-brown, very fine- to medium-grained sandstone and siltstone. Poorly cemented and so weathers to densely vegetated slopes. Upper contact is the Cretaceous unconformity; near Birch Spring, Winsor strata are overlain by Cedar Mountain conglomerate, but in the northwest corner of the quadrangle, the conglomerate is missing and Winsor is overlain by Dakota strata. Deposited on a broad, sandy mudflat. Thickens westward from about 240 to 320 feet (73-98 m) thick.

Jcp **Paria River Member** – Laminated to very thin-bedded, light-gray argillaceous limestone and micritic limestone that locally overlies a thick, white, alabaster gypsum bed. Limestone weathers to small chips and plates; forms steep, ledgy slopes; and locally contains small pelecypod fossils. Upper contact is sharp and planar. Deposited in shallow-marine and coastal-sabkha environments. About 50 to 160 feet (15-48 m) thick.

Jcx **Crystal Creek Member** – Thin- to medium-bedded, reddish-brown gypsiferous siltstone, mudstone, and very fine- to medium-grained sandstone. Typically friable and weakly cemented with gypsum. Forms vegetated, poorly exposed slopes. Upper contact is sharp and broadly wavy and corresponds to the base of a thick Paria River gypsum bed or argillaceous limestone interval. Deposited in coastal-sabkha and tidal-flat environments. About 150 to 250 feet (46-76 m) thick.

Co-op Creek Limestone Member – Thin- to medium-bedded, light-gray micritic limestone and calcareous shale. Locally contains *Pentacrinus* sp. columnals, pelecypods, and gastropods. Deposited in a shallow-marine environment.

Jccu – **Upper unit** of thin- to medium-bedded, light-gray-weathering micritic limestone; locally oolitic and sandy. Forms sparsely vegetated, ledgy slopes and cliffs. Upper contact is sharp and planar. About 100 to 140 feet (30-43 m) thick.

Jccl – **Lower unit** of mostly thinly laminated to thin-bedded, light-gray-weathering calcareous shale and platy limestone. Forms steep, vegetated slopes. Contact with

upper unit is gradational and corresponds to a subtle break in slope and vegetation patterns. About 240 to 380 feet (73-116 m) thick.

unconformity (J-2)

Temple Cap Formation

Jtw **White Throne Member** – Very thick-bedded, yellowish-gray to pale-orange, well-sorted, fine-grained quartz sandstone with large high-angle cross beds; similar to the Navajo Sandstone. Upper contact is sharp and planar and corresponds to the J-2 unconformity. Deposited in coastal dune field. Pinches out westward under the Upper Kolob Plateau due to truncation beneath the J-2 unconformity. 0 to 130 feet (0-40 m) thick.

Jts **Sinawava Member** – Interbedded, slope-forming, moderate-reddish-brown mudstone, siltstone, and very fine-grained silty sandstone. Forms narrow, but prominent, deep-reddish-brown, vegetated slope at the top of the Navajo Sandstone. Upper contact is gradational and interfingering with the White Throne Member, and, in western exposures, unconformable with light-gray calcareous shale and micritic limestone of the Co-op Creek Limestone Member. Deposited in coastal-sabkha and tidal-flat environments. About 10 to 40 feet (3-12 m) thick.

unconformity (J-1)

Jn **Navajo Sandstone** – Moderate-reddish-orange to moderate-orange-pink, massively cross-bedded, poorly to moderately well-cemented sandstone that consists of well-rounded, fine- to

medium-grained, frosted quartz. Contains few planar interdune deposits. Forms spectacular, sheer cliffs and is locally prominently jointed. Upper, unconformable contact is sharp and planar and corresponds to a prominent break in slope, with cliff-forming, cross-bedded sandstone below and reddish-brown mudstone above. Deposited in a vast coastal and inland dune field with prevailing winds principally from the north; lower few hundred feet represents deposition in a sand-dominated sabkha environment. About 2,100 to 2,200 feet (640-670 m) thick.

Jk **Kayenta Formation** – Interbedded, thin- to very thick-bedded, moderate-reddish-brown siltstone, fine-grained sandstone, and mudstone with planar, low-angle, and ripple cross-stratification; contains several thin, light-olive-gray weathering, light-gray dolomite beds. Upper contact is conformable and gradational and corresponds to the top of the highest thin siltstone and mudstone beds, above which lie the towering cliffs of Navajo Sandstone. Deposited in fluvial, distal fluvial/playa, and minor lacustrine environments. Only upper few tens of feet of the formation is exposed in the quadrangle at Hop Valley, but the entire formation is about 800 to 1,000 feet (244-305 m) thick.

Subsurface units – shown in cross section only.

Jm Moenave Formation, undivided

TRc Chinle Formation, undivided

TRm Moenkopi Formation, undivided

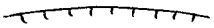
Map Symbols

Contact, dashed where approximately located


Normal fault, dashed where approximately located, dotted where concealed; bar and ball on down-thrown side

Structure contour on top of Navajo Sandstone and Tibbet Canyon Member; interval 100 feet

Major joint


Landslide or slump scarp, teeth on down-dropped side

Approximate strike and dip of inclined bedding determined photogrammetrically


Pit - sand and gravel (no letter), cinders (c)

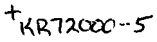

Quarry


Joint, near vertical

Spring


Volcanic vent


Collapse feature



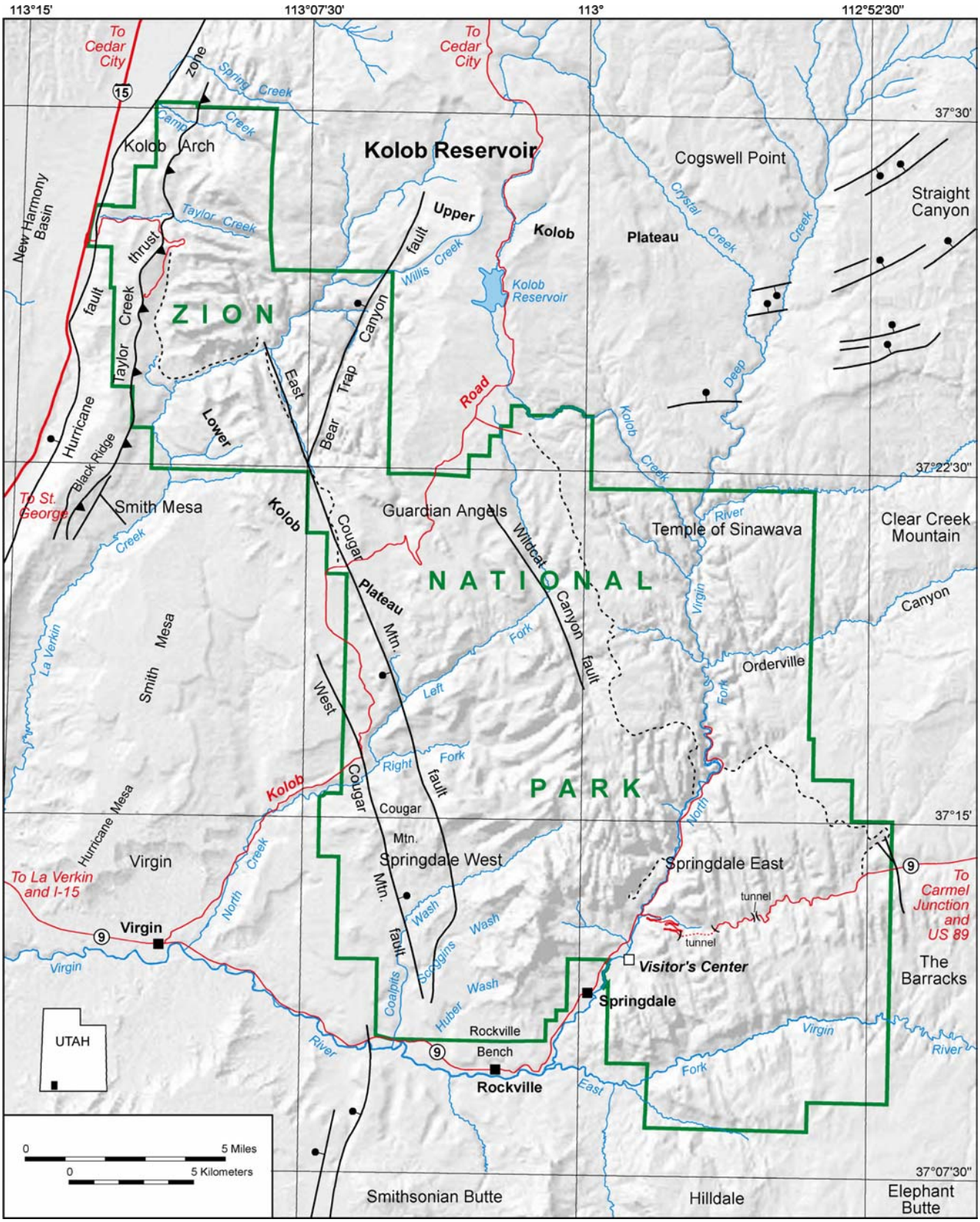
Sample location and number

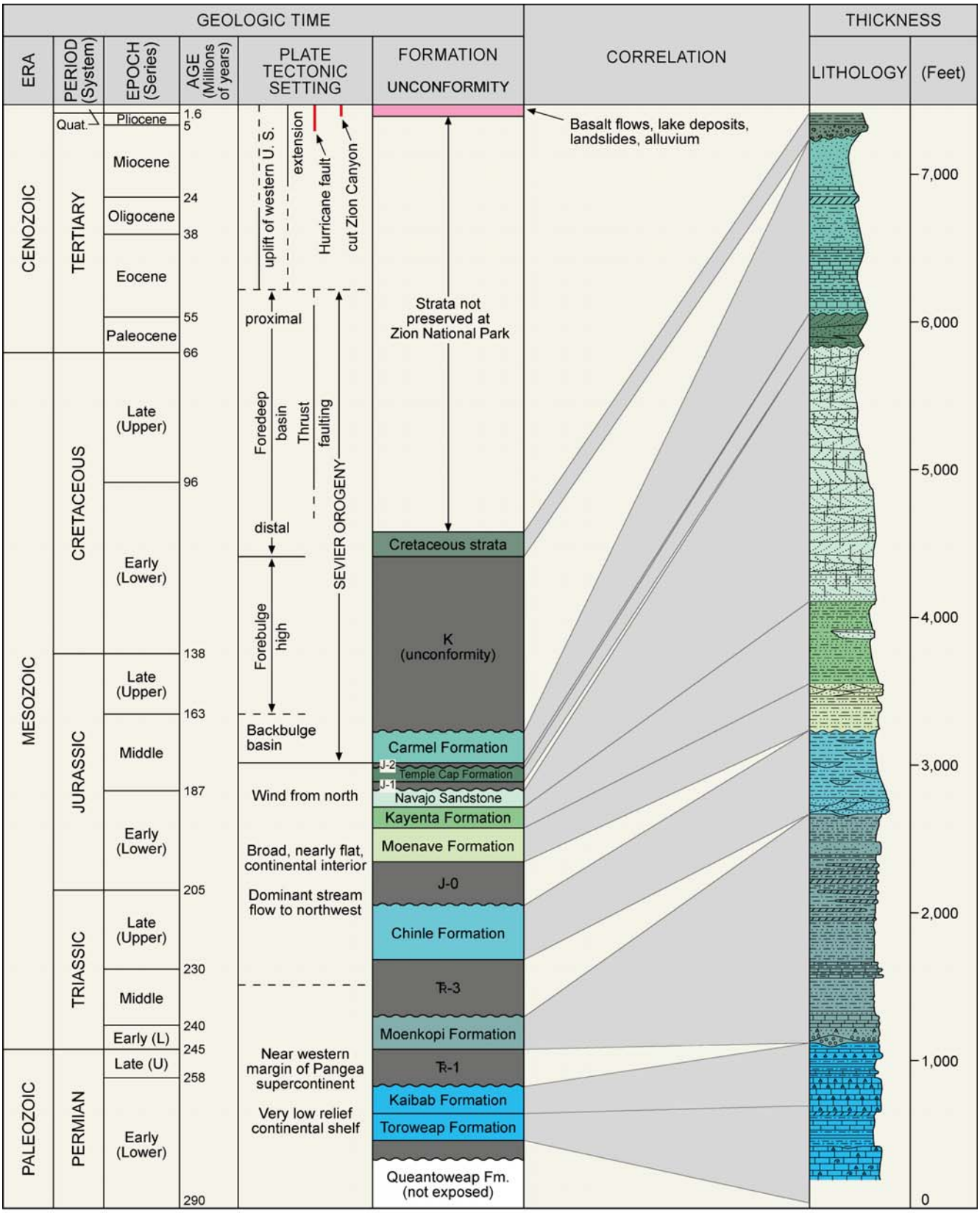
References

Biek, R.F., and Hylland, M.D., 2002, Interim geologic map of the Cogswell Point quadrangle, Washington, Kane, and Iron Counties, Utah: Utah Geological Survey Open-File Report 388, scale 1:24,000.

Eardley, A.J., 1966, Rates of denudation in the High Plateaus of southwestern Utah: Geological Society of America Bulletin, v. 77, p. 777-780.

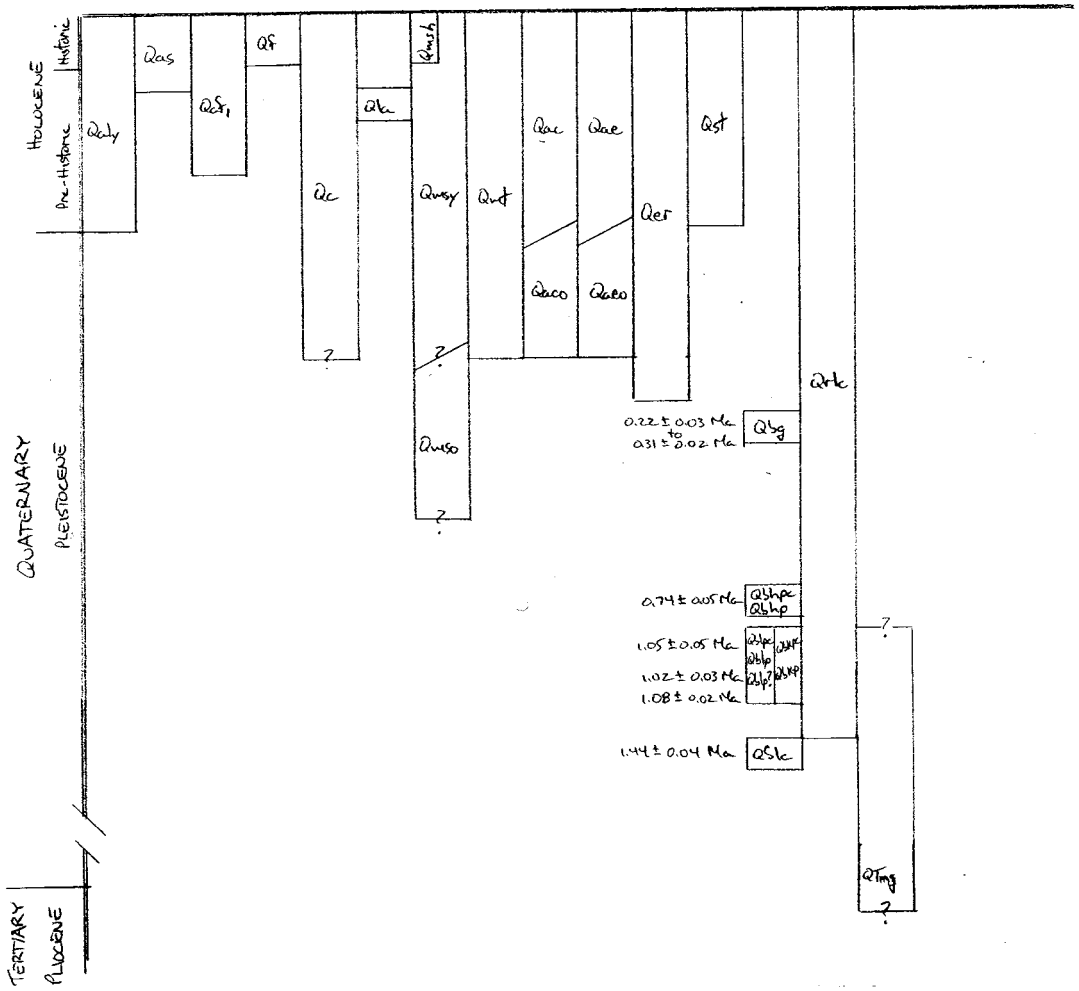
Willis, G.C., and Hylland, M.D., in preparation, Interim geologic map of The Guardian Angels quadrangle, Washington County, Utah: Utah Geological Survey Open-File Report xxx, scale 1:24,000.

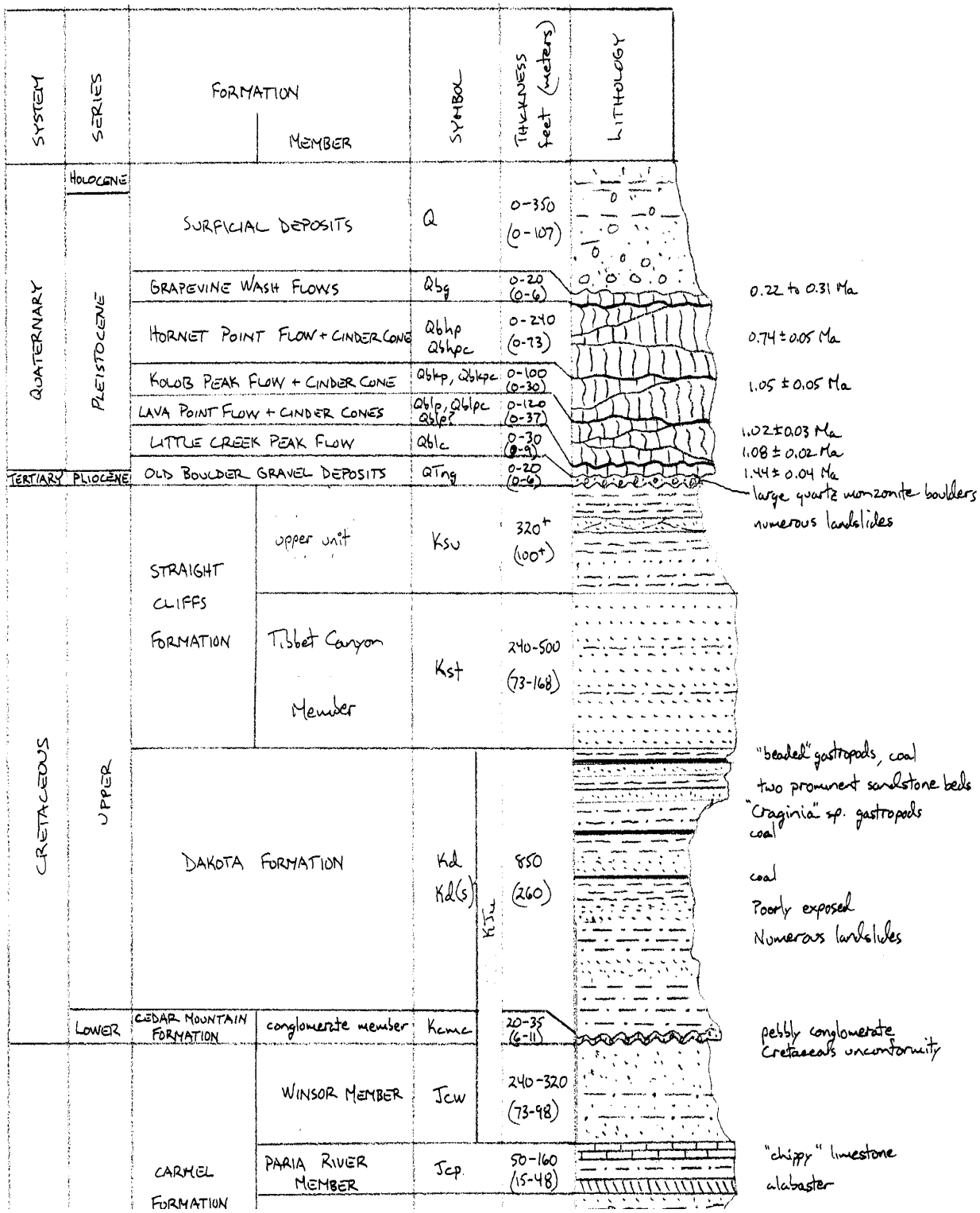

113°15'
113°07'30'
113°
112°52'30"
37°30'
37°22'30"
37°15'
37°07'30"
To Cedar City
15
Spring Creek
Camp Creek
Kolob Arch
Kolob Reservoir
Cogswell Point
Straight Canyon
New Harmony Basin
Taylor Creek
thrust
fault
Upper
Kolob
Plateau
Crystal Creek
Creek
Willis Creek
Kolob Reservoir
Taylor Creek
ZION
Hurricane
Black Ridge
Lower
East
Bear Trap Canyon
Road
Deep
Kolob Creek
To St. George
Smith Mesa
Kolob
Cougar
Guardian Angels
Temple of Sinawava
Clear Creek Mountain
River
Wildcat Canyon fault
NATIONAL
Plateau
Mtn.
Virgin
Canyon
La Verkin Creek
Smith Mesa
Fork
Orderville
West
Left
Fork
Right
Fork
fault
Kolob
Cougar
Mtn.
PARK
North
Fork
Hurricane Mesa
Virgin
Springdale West
Springdale East
To La Verkin and I-15
North Creek
Virgin
tunnel
To Carmel Junction and US 89
Wash
Wash
fault
Scoggins
Visitor's Center
The Barracks
Springdale
Coalpits
Huber
Wash
Rockville
Bench
Rockville
Virgin
River
East
Fork
Virgin
River
UTAH
0
5 Miles
0
5 Kilometers
Smithsonian Butte
Hilldale
Elephant Butte

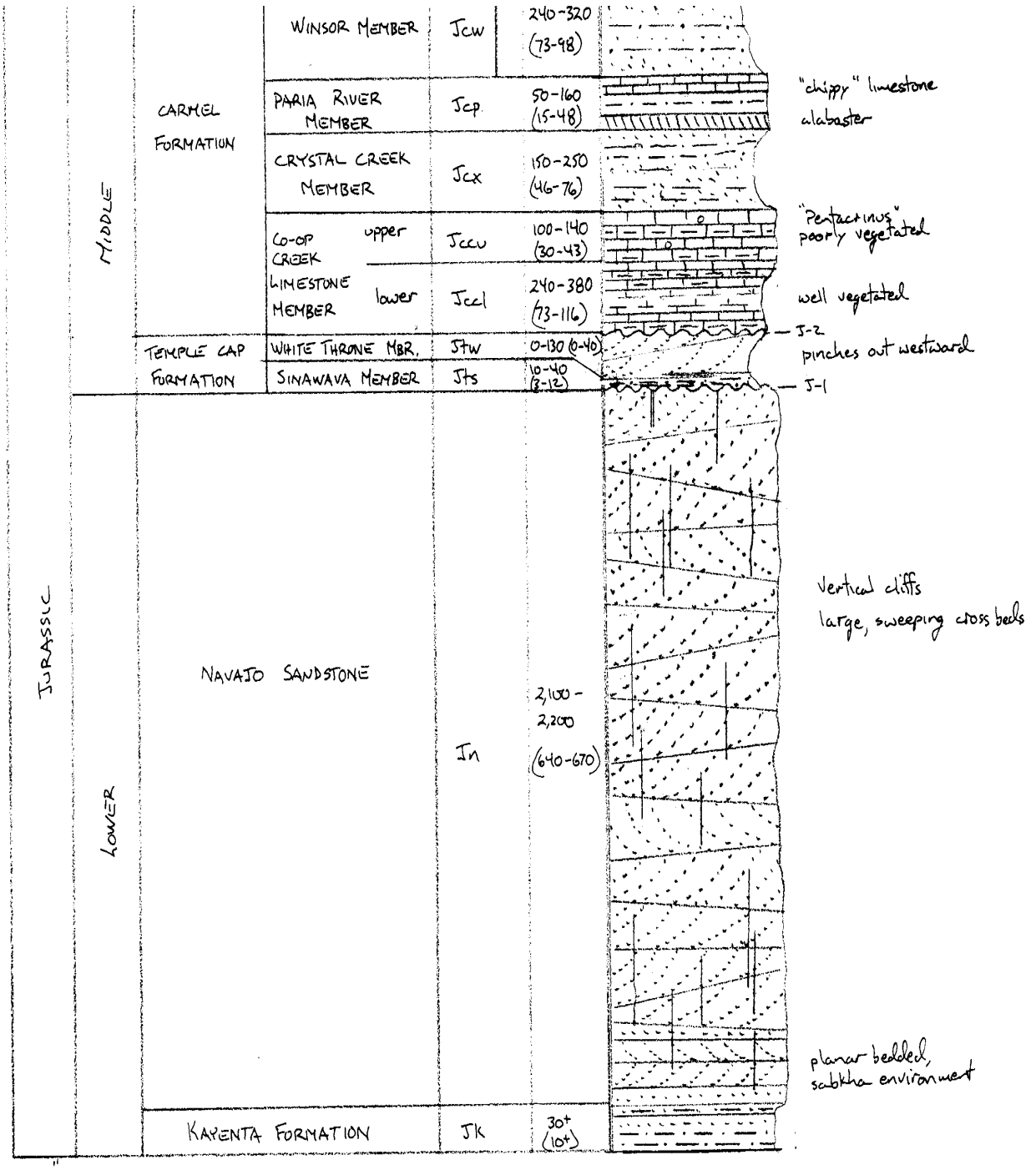


Relationship between age and thickness of rocks exposed in Zion National Park.

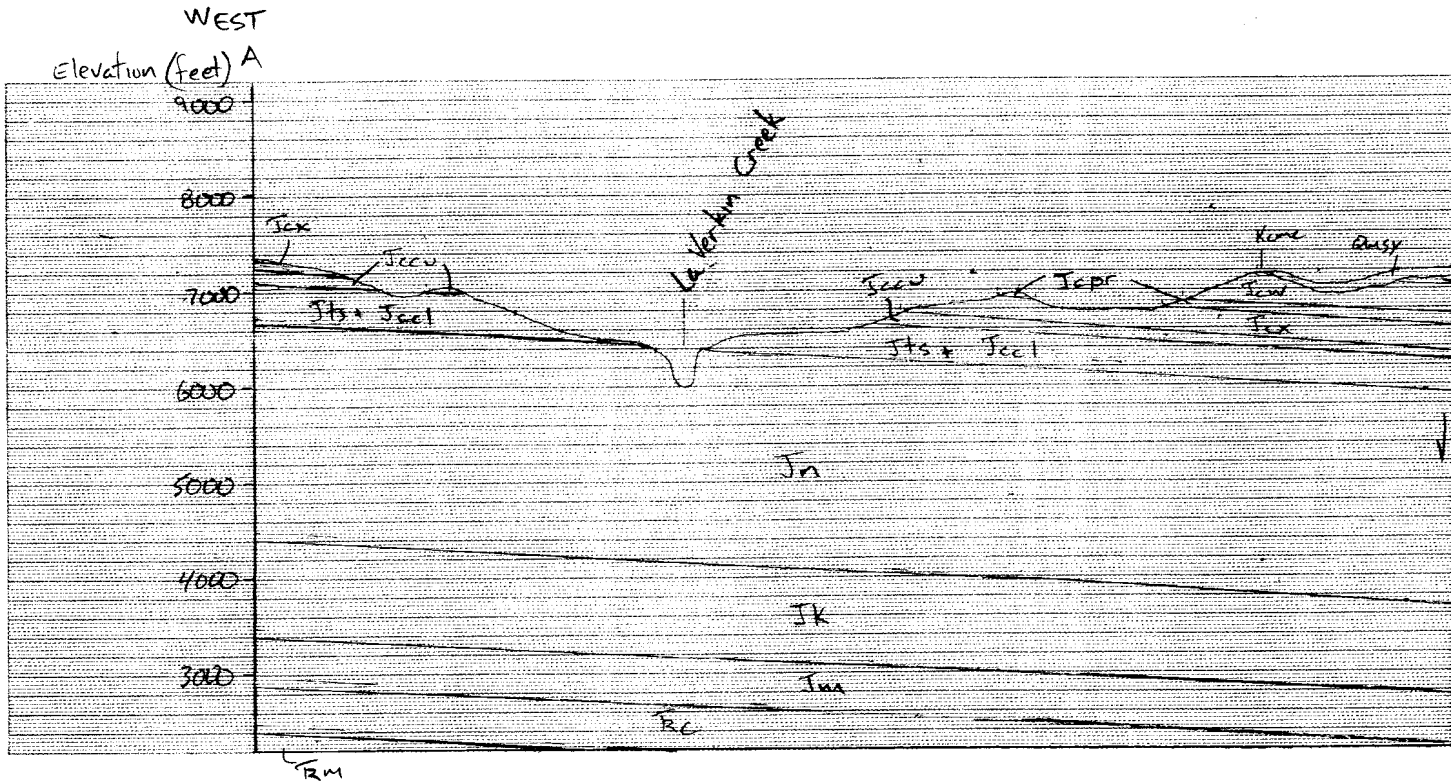
CORRELATION OF SURFICIAL MAP UNITS - KOLOB RESERVOIR QUADRANGLE

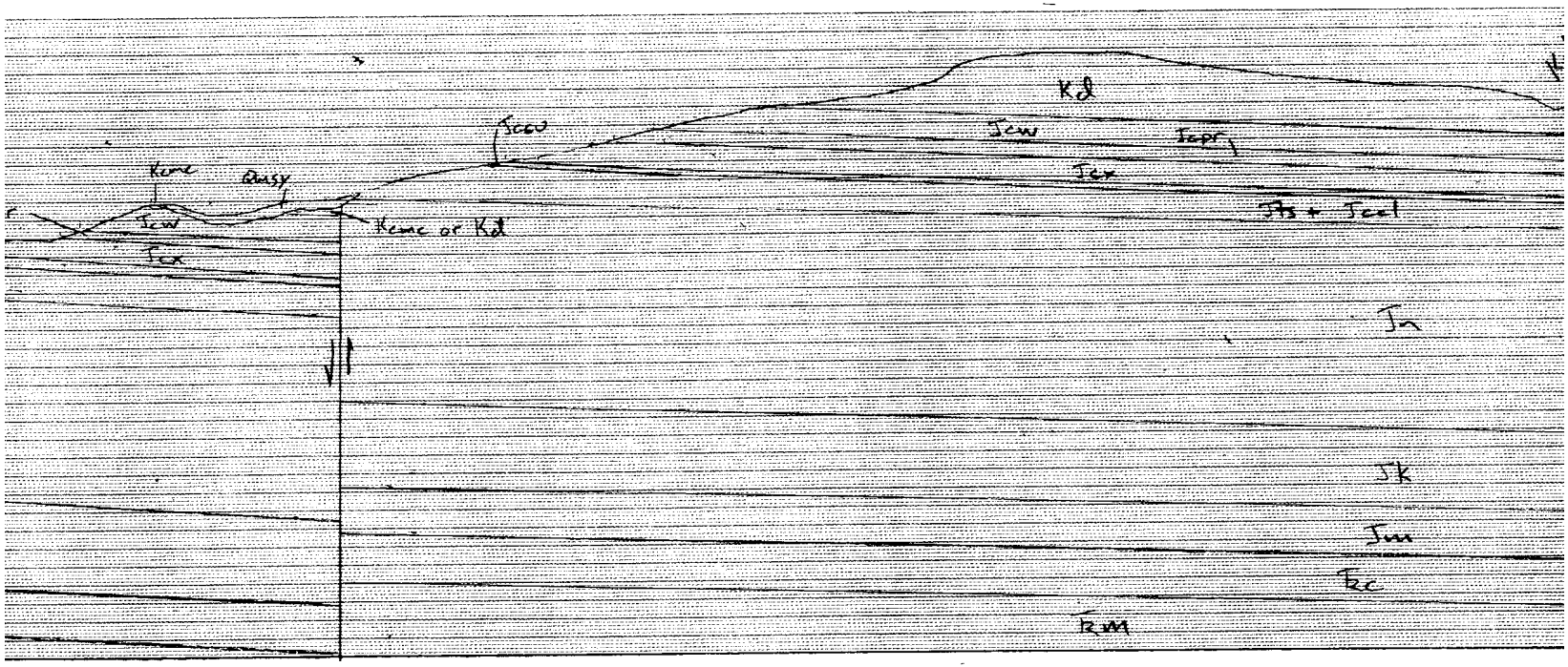


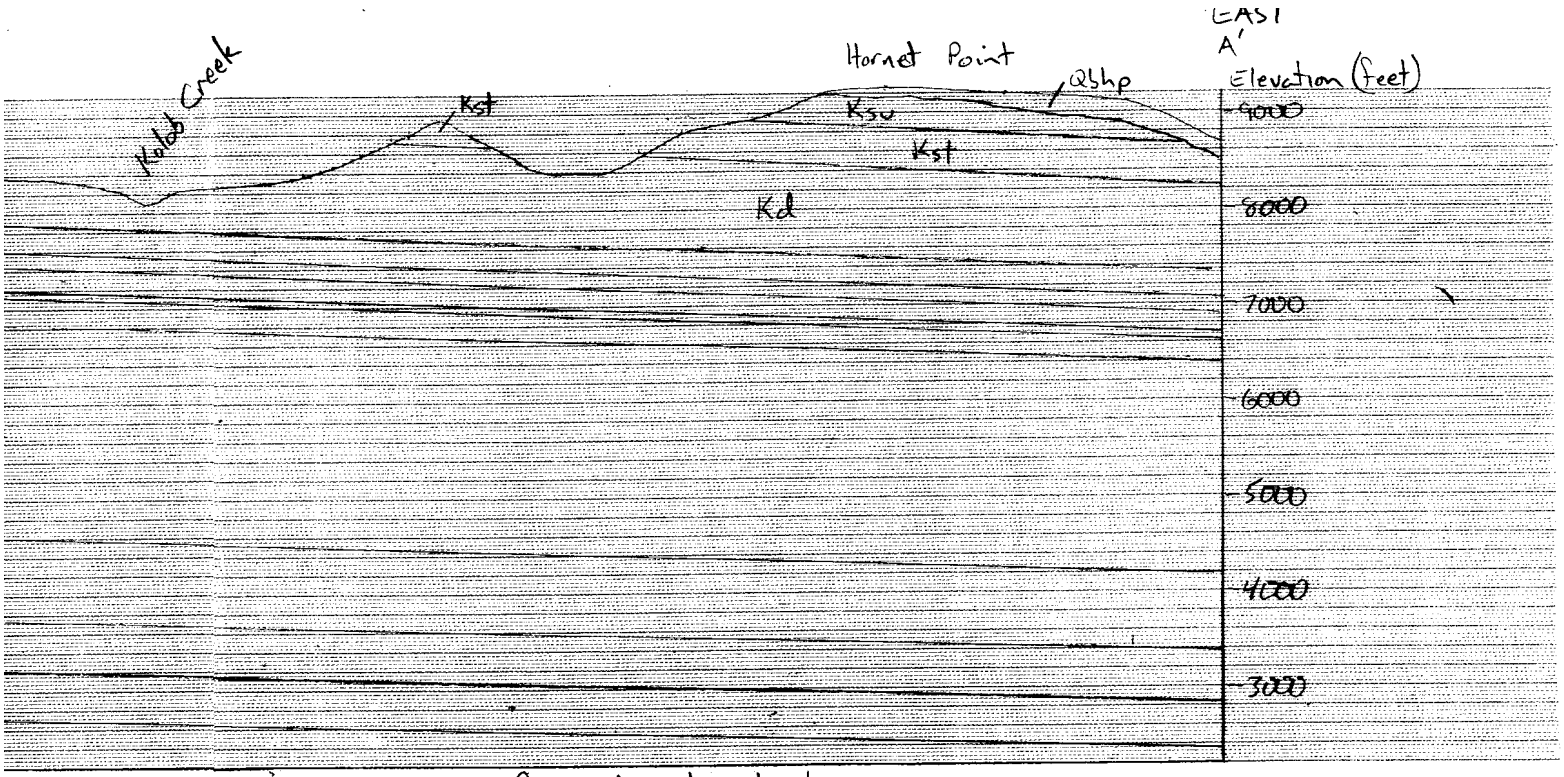

SYSTEM
SERIES
FORMATION
MEMBER
SYMBOL
THICKNESS feet (meters)
LITHOLOGY
QUATERNARY
HOLOCENE
PLEISTOCENE
SURFICIAL DEPOSITS
Q
0-350
(0-107)
GRAPEVINE WASH FLOWS
Qbg
0-20
(0-6)
0.22 to 0.31 Ma
HORNET POINT FLOW + CINDER CONE
Qbhp
Qbhpc
0-240
(0-73)
0.74 ± 0.05 Ma
KOLOB PEAK FLOW + CINDER CONE
Qbkp, Qbkpc
0-100
(0-30)
1.05 ± 0.05 Ma
LAVA POINT FLOW + CINDER CONES
Qblp, Qblpc
Qblps
0-120
(0-37)
1.02 ± 0.03 Ma
LITTLE CREEK PEAK FLOW
Qblc
0-30
(0-9)
1.08 ± 0.02 Ma
TERTIARY
PLIOCENE
OLD BOULDER GRAVEL DEPOSITS
QTng
0-20
(0-6)
1.44 ± 0.04 Ma
large quartz monzonite boulders
numerous landslides
CRETACEOUS
UPPER
STRAIGHT CLIFFS FORMATION
upper unit
Ksu
320+
(100+)
Tibbet Canyon Member
Kst
240-500
(73-168)
"beaded" gastropods, coal
two prominent sandstone beds
"Craginia" sp. gastropods
coal
DAKOTA FORMATION
Kd
Kd(s)
Kfu
850
(260)
coal
Poorly exposed
Numerous landslides
LOWER
CEDAR MOUNTAIN FORMATION
conglomerate member
Kcmc
20-35
(6-11)
pebbly conglomerate
Cretaceous unconformity
WINSOR MEMBER
Jcw
240-320
(73-98)
CARMEL FORMATION
PARIA RIVER MEMBER
Jcp
50-160
(15-48)
"chippy" limestone
alabaster



KOLOB RESERVOIR QUADRANGLE


WEST
Elevation (feet)
A
9000
8000
7000
6000
5000
4000
3000
Jcx
Jccu
Jts + Jccl
Jccu
Jcpr
Jts + Jccl
Kcw
Kox
Qusx
Jm
Jk
Jmn
Rc
Rm

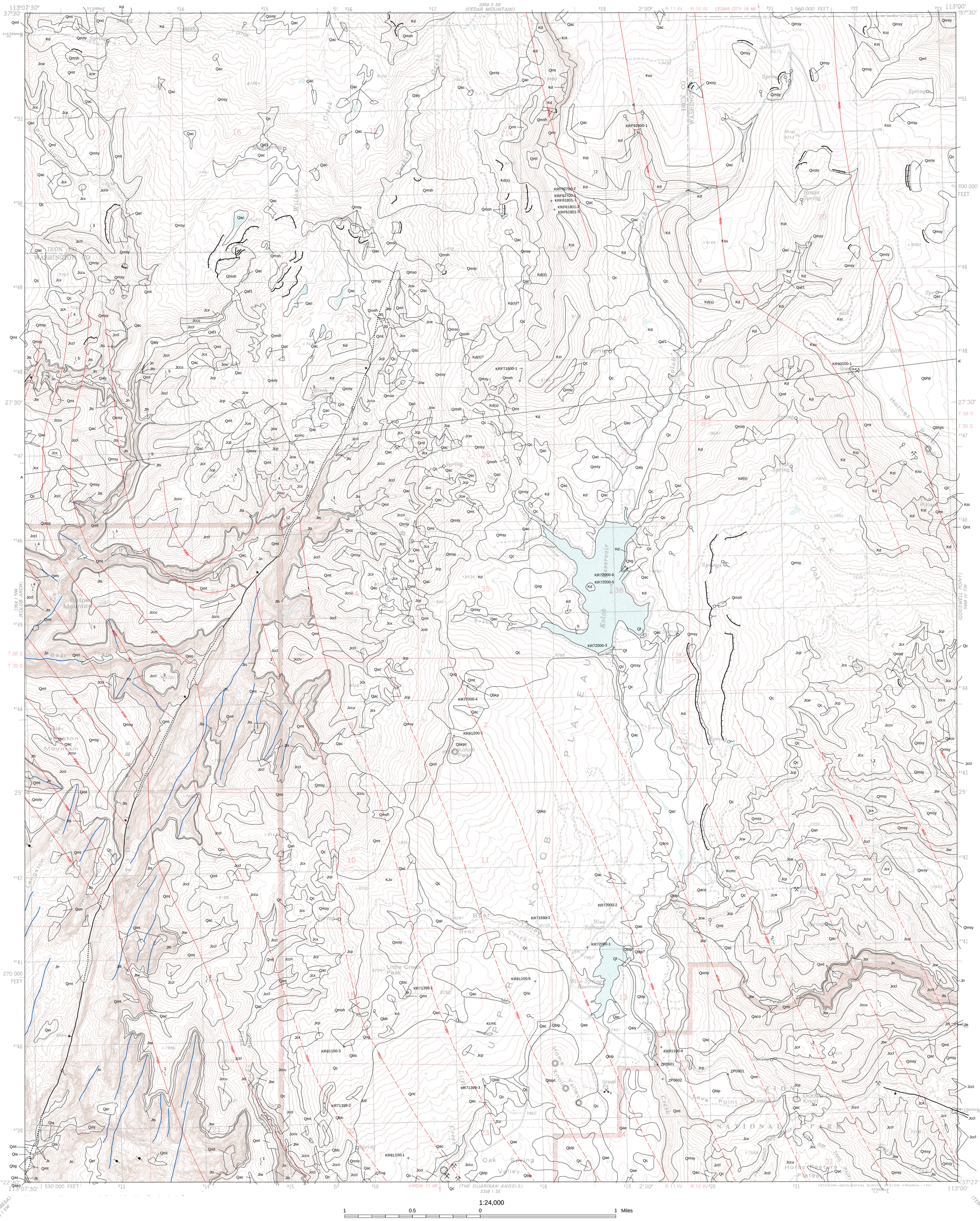

Kd
Jcw
Jcr
Jfs + Jcol
Jn
Jk
Jm
Jc
Rm
Kcmc
Qmsy
Jcw
Jcx
Kcmc or Kd



Thin surficial deposits not shown.

UTAH GEOLOGICAL SURVEY
a division of the
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with the
NATIONAL PARK SERVICE

Plate 1
Utah Geological Survey Open-File Report 387
Interim Geologic Map of the Kolob Reservoir Quadrangle



Interim Geologic Map of the Kolob Reservoir Quadrangle, Washington and Iron Counties, Utah

by
Robert F. Biek

2002